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Happiness and Social Behavior

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Abstract

It is often assumed that there is a robust positive symmetrical relationship between happiness and social behavior: Social relationships are viewed as essential to happiness, and happiness is thought to foster social relationships. However, empirical support for this widely held view is surprisingly mixed, and this view does little to clarify which social partner a person will be motivated to interact with when happy. To address these issues, we monitored the happiness and social interactions of more than 30,000 people for a month. We found that patterns of social interaction followed the *hedonic-flexibility principle*, whereby people tend to engage in happiness-enhancing social relationships when they feel bad and sustain happiness-decreasing periods of solitude and less pleasant types of social relationships that might promise long-term payoff when they feel good. These findings demonstrate that links between happiness and social behavior are more complex than often assumed in the positive-emotion literature.

Keywords

happiness, social behavior, motivation, emotion, open data, open materials

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Happiness and social behavior are typically viewed as enhancing one another in a reciprocal and symmetrical fashion (Cai, Zhu, Lin, Zhang, & Margraf, 2017; Diener, Kanazawa, Suh, & Oishi, 2015; Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Ramsey & Gentzler, 2015). Indeed, the evidence for the notion that engaging in social relationships promotes happiness is quite strong. At the trait level, cross-sectional studies consistently show a positive correlation between how happy people generally feel and the amount of time they spend with their friends and family (Diener & Seligman, 2002; Mehl, Vazire, Holleran, & Clark, 2010). At the state level, diary and experience-sampling studies consistently show that people report feeling happier when they are with friends, family members, and even acquaintances than when they are alone (Larson, Mannell, & Zuzanek, 1986; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Sandstrom & Dunn, 2014b). Finally, experimental studies have consistently demonstrated that interventions aimed at increasing social engagement lead to higher levels of happiness (Epley & Schroeder, 2014; Zelenski, Santoro, & Whelan, 2012). Whereas most prior studies are silent as to which specific relationships matter most for happiness (e.g., by lumping together siblings, parents, and children as family; for an exception, see Larson et al., 1986), dozens of studies employing a wide range of methods point to the general conclusion that being with other people makes us happy.

But does being happy lead us to seek the company of other people? Many researchers would say yes, arguing that a central evolutionary purpose of happiness is to foster and strengthen bonds between people, increasing reproductive fitness (Diener et al., 2015; Waugh &

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Fredrickson, 2006). However, empirical studies testing the notion that happiness promotes social behavior have yielded conflicting findings. On the one hand, people tend to report feeling more social when they are in a happy mood and less social when they are in an unhappy mood (Diener et al., 2015; Watson et al., 1995). Moreover, after a happy-mood induction, people express greater interest in hypothetical social activities (Cunningham, 1988b; Strickland, Hale, & Anderson, 1975; Whelan & Zelenski, 2011), communicate more with a stranger of the opposite gender (Cunningham, 1988a), and display more courage in social-anxiety-provoking situations (Kryś, 2010) than after an unhappy-mood induction. On the other hand, decades of research on coping and attachment have demonstrated that people are particularly likely to seek contact with others in times of distress rather than happiness (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969). For example, in one classic experiment, participants were told that they would be given painful or painless electric shocks before choosing to wait either with other people or alone prior to the procedure. More people preferred to wait in the company of others when told they would receive the painful electric shocks (Schachter, 1959). Since this early research, a large body of work has shown that one of the most frequent coping and mood-repair strategies that people use when they feel bad is to call, talk to, or be with someone (Funabiki, Bologna, Pepping, & FitzGerald, 1980; Parker & Brown, 1982; Thayer, Newman, & McClain, 1994).

One way to reconcile these conflicting findings lies in recent research showing that everyday patterns of activity seem to be governed by the *hedonic-flexibility principle* (Taquet, Quoidbach, de Montjoye, Desseilles, & Gross, 2016), according to which one of the functions of affective states is to help individuals prioritize among short-term goals (e.g., feeling happy) and long-term goals (e.g., working hard to lose weight). This research suggests that when they feel bad, people tend to engage in mood-enhancing behaviors. But when they feel good, people seem willing to sacrifice some of their current happiness, engaging in less immediately rewarding behaviors that might promise long-term payoff. Applied to the regulation of everyday social behavior, the hedonic-flexibility principle suggests that people should be particularly prone to seek pleasant social relationships when they feel unhappy, consistent with the large body of work on coping and attachment. However, the hedonic-flexibility principle also suggests that happiness might help individuals to feel more social and gather the social courage to engage in less pleasant types of social relationships (e.g., approaching a stranger), consistent with results from the experimental paradigms used in the emotion literature.

To test these predictions, we examined data from a large experience-sampling study (Taquet et al., 2016), monitoring in real time the happiness and social interactions of thousands of people across an average of 30 days using a multiplatform smartphone application. We investigated how participants' current happiness (happiness at time t) related to the people with whom they interacted a few hours later (partner at time $t + 1$) and the relationship between these interaction partners and participants' subsequent happiness (change in happiness from time t to time $t + 1$), controlling for whether they were already interacting with that partner before (partner at time t), the time of the day, the day of the week, and average daily levels of happiness. This longitudinal approach allowed us to simultaneously examine, for the first time, both sides of the relationship between happiness and social behavior by computing (a) how one's current happiness relates to the odds of subsequently interacting with different types of interaction partners (i.e., who people talk to when they feel good or bad) and (b) how each type of interaction partner relates to one's subsequent happiness (i.e., how people feel as a result).

Method

Participants

Our sample was composed of 30,793 people (age: M = 27.0 years, SD = 9.0; 65% women) who provided experience-sampling reports about their happiness and social relationships several times a day, across an average of 30 days, using a multiplatform smartphone application. Participants were predominantly French, and all the questions were asked in French (for detailed information on the composition of the sample, see Section 1 in the Supplemental Material available online). For the purposes of this study, we selected pairs of consecutive reports within a 12-hr period, which resulted in a final sample of 220,294 pairs of reports (i.e., 220,294 observations at time t and 220,294 observations at time $t + 1$).

Procedure and experience sampling

Participants volunteered for the study by downloading "58 Seconds," a free francophone mobile application for iPhone and Android phones dedicated to measuring various aspects of users' well-being through short questionnaires presented at random times throughout the day. The project received significant media coverage in France. At initial sign-up, participants were asked to provide their age, gender, and country of residence.

Next, participants were asked which days of the week and within what time windows they wished to receive questionnaire requests (default = 7 days per week between 9:00 a.m. and 10:00 p.m. each day). Participants could also customize the number of daily questionnaire requests they wanted to receive (default = 4, range = 1–12). The application algorithm then divided each participant's day into a number of intervals equal to the number of samples to be requested, and a random time was chosen within each interval. The minimum time between two questionnaires was set to 1 hr to avoid large artifactual autocorrelations between answers to the same question in consecutive tests. Random sampling was ensured through a notification system that did not require users to be connected to the Internet. New random times were generated each day, and the times were independently random for each participant. At each of these times, participants received a notification on their mobile phone informing them that a new questionnaire was available (see Fig. S1a in the Supplemental Material). They then had the option to take the questionnaire, snooze it (i.e., delay it by 9 min), or reject it (see Fig. S1b in the Supplemental Material). If they accepted the questionnaire, participants were then asked a varying series of four to six questions drawn from a large battery of items (see Section 2 in the Supplemental Material). Of interest to the current research were two items: (a) participants' current happiness (answered on a slider from 0, *very unhappy*, to 100, *very happy*) and (b) whether participants were in the company of other people and, if so, whom (selected from a list of 10 nonmutually exclusive choices; see Fig. S1c in the Supplemental Material). The frequency of recorded results as a function of time and day is reported in Figure S2 in the Supplemental Material.

This study was approved by the ethics committee of ESADE Business School. The study method was carried out in accordance with the approved guidelines. At initial sign-up, participants provided their written informed consent. Our sample consisted of everyone who expressed interest in participating during the 18-month period in which the application was available. We have reported all measures, conditions, and data exclusions. Data have been made publicly available via the Open Science Framework and can be accessed at https://osf.io/fnps3.

Regression model

We assessed whether people's current happiness relates to the odds that they would subsequently engage with different interaction partners using a series of multilevel time-lagged binary logistic regression models to account for the nested structure of the data (with multiple observations nested within individuals). Because our goal was to capture the high-frequency dynamics in happiness (e.g., hourly changes in happiness) while controlling for the low-frequency dynamics (e.g., daily or weekly changes in happiness), we included daily average happiness as a covariate in the regression models. This guaranteed that associations between current happiness and future interaction partners were not merely reflecting long-term emotional trends. Specifically, we let H_t and H_{day} denote participants' happiness at time t and the average of all other happiness reports that day (excluding happiness at time t), respectively, and we let P^j_t and P^j_{t+1} be dichotomous variables denoting whether the participant was interacting with the jth interaction partner ($j = 1, \ldots, 10$) at time t and $t + 1$, respectively. If P^j_t equaled 1, then the participant was interacting with the jth interaction partner at time t, whereas the opposite was true if P^j_t equaled 0. Using multilevel logistic regressions, we can link H_t to the probability $P\left(P^j_{t+1}\right)$ that participants were interacting with the jth interaction partner. The generic regression model has the following expression:

$$\text{logit } P\left(P^j_{t+1}\right) = \beta^j_{0i} + \beta^j_{ci} H_t + \beta^j_{\text{day}} H_{\text{day}} + \sum_{k=1}^{K} \beta^j_k X_k,$$
$$\text{with } \beta^j_{0i} = \gamma^j_0 + u^j_{0i} \text{ and } \beta^j_{ci} = \gamma^j_c + u^j_{ci},$$

where β^j_{0i} is the random intercept (for the ith individual), β^j_{ci} is the random slope coefficient (for the ith individual) related to current happiness, and β^j_{day} is the coefficient related to daily average happiness. The terms in X_k are a set of possible covariates that need to be controlled for: the day of the week (e.g., people are more likely to interact with coworkers on a weekday than during the weekend), the time of day (e.g., people are more likely to see their friends at 6 p.m. than at 6 a.m.), and latency effects (e.g., some interactions may span a period that is longer than the time between two measurements). Preferences based on the day were expressed by adding a categorical variable D specifying whether the day of the measurement was a weekday, a Saturday, or a Sunday. Because no prior functional variation (e.g., linear or quadratic) of social interactions with respect to the time of day could be reasonably expressed, we represented the time of day as a categorical variable T by binning the time into 12 periods of 2 hr each (from 0:00:00 a.m.–1:59:59 a.m. to 10:00:00 p.m.–11:59:59 p.m.). Finally, the latency effect can be represented by adding the dichotomous variable P^j_t indicating whether one was already interacting with the jth interaction partner at the previous measurement (for details on the regression models, see Section 3.1

in the Supplemental Material). The complete model is therefore

$$\text{logit } P\left(P^j_{t+1}\right) = \beta^j_{0i} + \beta^j_{ci}\text{H}_t + \beta^j_{\text{day}}\text{H}_{\text{day}} + \beta_d D + \beta_T T + \beta_p P^j_t, \quad (1)$$
$$\text{with } \beta^j_{0i} = \gamma^j_0 + u^j_{0i} \text{ and } \beta^j_{ci} = \gamma^j_c + u^j_{ci}.$$

Statistical analyses

To assess whether people's current happiness significantly predicts their future social interactions, we tested the null hypothesis that the fixed coefficient γ^j_c equals 0 for each of the 10 categories of interaction partners. We rejected the null hypothesis if the corresponding *p* value was lower than .05 after Benjamini-Hochberg correction for multiple testing (Benjamini & Hochberg, 1995). If the null hypothesis was rejected and if γ^j_c was positive, then an increase in current happiness at time *t* was associated with an increase in the odds of interacting with the *j*th interaction partner at time $t + 1$. Conversely, if the null hypothesis was rejected and if γ^j_c was negative, then a decrease in current happiness at time *t* was associated with an increase in the odds to interact with the *j*th interaction partner at time $t + 1$.

The coefficients γ^j_c were reported as adjusted odds ratios (*OR*s) expressing the link between a high or low level of current happiness and the probability to later interact with a particular interaction partner. These adjusted *OR*s were reported for a difference in happiness set to 1 standard deviation in our sample ($\Delta Ht = 23.8$) and were calculated as follows: adjusted $OR^j = e^{\gamma^j_c \Delta \text{H}_t}$.

To assess the association between interaction partners and changes in happiness, we computed, for each interaction partner, the mean difference between future and current happiness ($\Delta\text{H} = \text{H}_{t+1} - \text{H}_t$), adjusted for time of day, day of the week, and latency effects. In other words, we computed the following regression model for each interaction partner:

$$\Delta\text{H} = \delta^j_{0i} + \delta^j_d D + \delta^j_t T + \delta^j_p P^j_t + \Delta\text{H}_j P^j_{t+1},$$
$$\text{with } \delta^j_{0i} = \epsilon^j_0 + \nu_{0i}.$$

In this model, each ΔH_j corresponds to the change in happiness that occurs, on average, when participants start interacting with the *j*th interaction partner, whereas the terms in *D* and *T* account for the fact that changes in happiness can also be associated with the day of the week or time of day. The terms in P^j_t account for the fact that social interactions may span several observations. Note that ΔH_j should not be confused with ΔH_t used above: ΔH_j represents an observed change in happiness between time *t* and time $t + 1$ when the participant interacts with the *j*th interaction partner at time $t + 1$, whereas ΔH_t represents a deviation in the level of happiness at time *t* that is arbitrarily fixed to some value (fixed to 1 *SD* for visualization purposes) to observe the impact that such deviation of happiness would have on the subsequent likelihood of interacting with a certain interaction partner (for details, see Section 3.2 in the Supplemental Material).

Interpretation of ORs

In the Results section, we provide an example of the impact of current happiness on an average participant's likelihood of later interacting with either a friend or a stranger. The result of this example can be obtained as follows. The *OR* of interacting with a particular partner is given by the product of adjusted *OR*s for all independent variables (current interaction partners, current happiness, time of day, etc.) as described by logistic regressions. All other factors being equal, the impact of a change in current happiness on the *OR* to later interact with a specific partner may be found by multiplying the baseline *OR* of that partner by the adjusted *OR* $e^{\gamma^j_c \Delta \text{H}_t}$ due to happiness. The base-rate frequencies at which participants in our study were interacting with their friend or interacting with a stranger on a Saturday between 2:00 p.m. and 4:00 p.m. were 8.18% and 4.10%, respectively. The corresponding baseline *OR*s, $OR = P/(1 - P)$, were 0.089 and 0.043, respectively. In our data, the average happiness on Saturday at noon—the time period preceding (i.e., time *t*) the target period of Saturday between 2:00 p.m. and 4:00 p.m. (i.e., time $t + 1$)—was 64.8 across the entire sample. The *OR* for an individual scoring 90 on the happiness scale is simply obtained by multiplying the baseline *OR* by $e^{\gamma^j_c \times (90-64.8)}$, and the *OR* for an individual scoring 10 on the happiness scale is simply obtained by multiplying the baseline *OR* by $e^{\gamma^j_c \times (10-64.8)}$. Using the value of γ^j_c corresponding to friend and stranger, we obtained the *OR*s of seeking a friend as follows:

$OR = 0.089 \times 0.814 = 0.072$ for $\Delta Ht = 90 - 64.8$, and
$OR = 0.089 \times 1.563 = 0.139$ for $\Delta Ht = 10 - 64.8$.

Similarly, we obtained the *OR*s of engaging with a stranger as follows:

$OR = 0.043 \times 1.067 = 0.046$ for $\Delta Ht = 90 - 64.8$, and
$OR = 0.043 \times 0.869 = 0.037$ for $\Delta Ht = 10 - 64.8$.

These *OR*s can be transformed back to the probability of interacting with these people by using the inverse formula for *OR*s: $P = OR/(1 + OR)$.

Ruling out explanations by natural rhythms

Social behavior in everyday life might follow a systematic pattern or rhythm (e.g., people may more often be with strangers on their evening commute and with family at night rather than the other way around; Zhang et al., 2015). Similarly, happiness might follow a natural rhythm (e.g., people typically feel happier after lunch than before lunch; Golder & Macy, 2011).

If social relationships followed a natural rhythm (a pattern observed in our data; see Fig. S3 in the Supplemental Material) that was not affected by happiness but caused corresponding changes in happiness (e.g., interacting with family makes people happy, interacting with strangers makes people less happy, and people typically see their family after commuting), then one might expect to observe associations between happiness and types of interaction partners that are similar to the ones we observed, even if happiness actually does not relate in any way to social behavior. In that case, the effect of happiness at time t as a predictor of interaction partners at time $t + 1$ would be mediated by interaction partners at time t. To rule out this alternative explanation, we computed, for each type of interaction partner at time $t + 1$, a regression model similar to Model 1 but in which all interaction partners at time t were included as covariates:

$$\text{logit } P\left(P^j_{t+1}\right) = \beta^j_{0i} + \beta^j_{ci}\mathrm{H}_t + \beta^j_{\text{day}}\mathrm{H}_{\text{day}} + \beta_d D + \beta_T T + \Sigma^{10}_{k=1}\,\beta^{jk}_p P^k_t, \quad \text{with } \beta^j_{0i} = \gamma^j_0 + u^j_{0i} \text{ and } \beta^j_{ci} = \gamma^j_c + u^j_{ci}. \tag{2}$$

The coefficient β^{jk}_p represents the link between interacting with the kth interaction partner at time t and the probability to interact with the jth interaction partner at time $t + 1$, thereby capturing potential natural rhythms in daily social interactions. The explanation of findings by natural rhythms of social interactions can be excluded if most significant effects (significant γ^j_c) in Model 1 remain significant at $p < .05$ in Model 2 and if there is a strong and statistically significant correlation between the coefficients (γ^j_c) in Model 1 and the corresponding coefficients in Model 2.

If happiness follows a natural daily rhythm (a pattern that was observed in our data; see Fig. S4 in the Supplemental Material) and if peaks and troughs in that rhythm correlate with certain daily activities (e.g., people are less happy at 3:30 p.m.—a time when they are also incidentally more likely to be interacting with colleagues—than at 7:30 p.m.—a time when they are more likely to be interacting with their partners), one might expect to observe associations between happiness and social behavior that are similar to the ones we observed, even if the different interaction partners actually did not affect people's happiness. To rule out this alternative explanation, we created a new variable $\mathrm{H}^n_t = \mathrm{H}_t - \bar{\mathrm{H}}_t$ representing normalized happiness by subtracting from the happiness variables H_t the population-wise average happiness $\bar{\mathrm{H}}_t$ at that time of day and ran the analyses again with this normalized variable instead of the original happiness score. Specifically, we estimated the following regression model:

$$\text{logit } P\left(P^j_{t+1}\right) = \beta^j_{0i} + \beta^j_{ci}\mathrm{H}^n_t + \beta^j_{\text{day}}\mathrm{H}_{\text{day}} + \beta_d D + \beta_T T + \beta_p P^j_t, \quad \text{with } \beta^j_{0i} = \gamma^j_0 + u^j_{0i} \text{ and } \beta^j_{ci} = \gamma^j_c + u^j_{ci}. \tag{3}$$

Using a normalized happiness level guarantees that any observed effect is independent of a global impact of daily rhythms of happiness. The explanation of findings by natural rhythms of happiness can be excluded if most significant effects (significant γ^j_c) in Model 1 remain significant at $p < .05$ in Model 3 and if there is a strong and statistically significant correlation between the coefficients (γ^j_c) in Model 1 and the corresponding coefficients in Model 3.

Results

Preliminary analyses

To set the stage for our primary analyses, we first examined cross-sectional relations between happiness and social behavior. In line with decades of research in social sciences, we found a clear linear relationship between participants' average level of happiness and their overall social engagement, $r(30790) = .22$, $p < .0001$. The happiest participants spend on average about twice as much time in the company of other people as the least happy participants (70% vs. 37% of the time; Fig. 1).

Examining more specific categories of interaction partners, we found that participants' average happiness level was related to how much time they spent—in order of importance—with their romantic partners, $r(30790) = .19$, $p < .0001$; friends, $r(30790) = .08$, $p < .0001$; best friends, $r(30790) = .06$, $p < .0001$; children, $r(30790) = .06$, $p < .0001$; other family members, $r(30790) = .04$, $p < .0001$; siblings, $r(30790) = .03$, $p < .0001$; acquaintances, $r(30790) = .02$, $p < .0001$; coworkers or clients, $r(30790) = .02$, $p < .0001$; and parents, $r(30790) = .01$, $p < .05$. The time they spent in the company of strangers was unrelated to happiness, $r(30790) = .00$, $p = .35$. These findings suggest that social contacts—especially with people who are close—play a role in people's happiness. But do lag-lead temporal analyses support the idea that happiness leads to social behavior and vice versa?

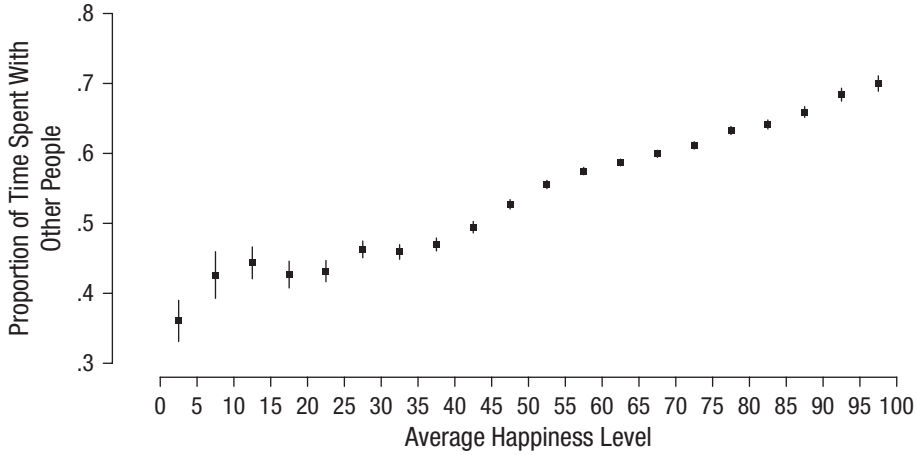

Fig. 1. Participants' average level of happiness as a function of the proportion of time spent in the company of other people (vs. alone). Error bars depict 95% confidence intervals.

Primary analyses

Contrary to conventional wisdom, but consistent with the hedonic-flexibility principle, results of our temporal analyses revealed that the happier participants were at time *t*, the less likely they were to seek the presence of other people at time *t* + 1 (Fig. 2). For instance, if people's current happiness was 1 standard deviation above the sample mean (23.8 points in our sample), the adjusted *OR* of subsequently reporting being in the presence of other people was 0.94, 95% confidence interval (CI) = [0.92, 0.95], $p < .0001$.

Breaking down the results by specific categories of interaction partners provided further evidence for a hedonic-flexibility account of everyday social behavior. When participants were feeling unhappy, they were more likely to subsequently spend time with people who tended to boost their happiness (Fig. 3a, light gray bars). For instance, if participants' current happiness was 1 standard deviation below the sample mean, they were more likely to later interact with their friends, adjusted *OR* = 1.21, 95% CI = [1.18, 1. 25], $p < .001$; best friend, adjusted *OR* = 1.10, 95% CI = [1.07, 1.12], $p < .001$; other family members, adjusted *OR* = 1.09, 95% CI = [1.06, 1.13], $p < .001$; kids, adjusted *OR* = 1.08, 95% CI = [1.05, 1.11], $p < .001$; and siblings, adjusted *OR* = 1.05, 95% CI = [1.02, 1.08], $p < .01$, and all of these social interactions were in turn associated with a significant increase in happiness (Fig. 3b, light gray bars). In contrast, when participants were feeling happy (i.e., 1 *SD* above the sample mean), they were more likely to subsequently interact with strangers, adjusted *OR* = 1.06, 95% CI = [1.02, 1.10], $p < .01$ (Fig. 3a, dark gray bar), which, in turn, was associated with a significant decrease in happiness (Fig. 3b, dark gray bar). Finally, current happiness was largely unrelated to subsequent interactions with people who had little hedonic impact, namely, acquaintances, adjusted *OR* = 1.03, 95% CI = [1.00, 1.05], $p = .045$; parents, adjusted *OR* = 1.01, 95% CI = [0.99, 1.04], $p = .27$; and coworkers or clients, adjusted *OR* = 0.99, 95% CI = [0.96, 1.01], $p = .31$. One interesting exception to this pattern were interactions with one's romantic partner, which despite being positive in terms of happiness impact, were not reliably predicted by participants' previous happiness levels, adjusted *OR* = 1.02, 95% CI = [1.00, 1.04], $p = .14$.

For a concrete example to illustrate the magnitude of these effects, imagine what average individuals are likely to do on a Saturday afternoon. If they were particularly unhappy at noon (scoring 10 on the happiness scale), they would be 1.8 times more likely (12.2% vs. 6.8%) to see a friend in the afternoon than if they were particularly happy at noon (scoring 90 on the happiness scale). Likewise, if those individuals were particularly happy at noon, they would be about 1.2 times more likely (4.4% vs. 3.6%) to interact with a stranger in the afternoon than if they were particularly unhappy at noon.

Robustness

Our findings suggest that happiness relates to whom people interact with in the next few hours and that, in turn, these interaction partners relate to how happy they feel. This pattern of findings was robust to changes in model specification and replicated in five bootstrapped resamples of the data (see Section 3 in the Supplemental Material). However, several alternative explanations of the interplay that we observed between happiness and social behavior are possible. We address each of them in turn.

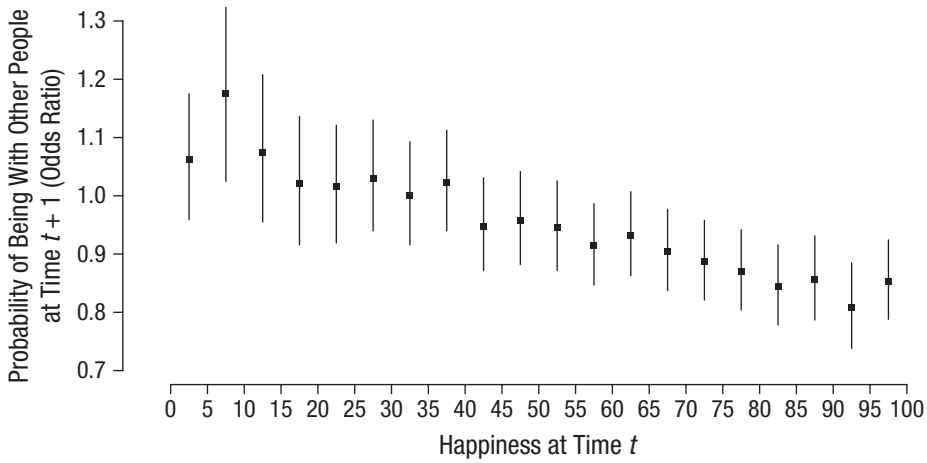

Fig. 2. Participants' momentary level of happiness at time *t* as a function of the probability that they would spend time in the company of other people (vs. alone) a few hours later (time *t* + 1). Error bars depict 95% confidence intervals.

Can the relationship between happiness and social behavior be explained by daily activities? In our previous work (Taquet et al., 2016), we found that people were more likely to engage in 10 happiness-increasing activities when they felt bad (i.e., sport, nature, leisure, chatting, culture, drinking, playing, eating, child care, and television) and to engage in 5 happiness-decreasing activities when they felt good (i.e., housework, commuting, sleeping, working, and waiting). Because some activities in which people tend to engage when they are in a negative mood are highly social (e.g., play sports), whereas some activities in which people engage when they are in a positive mood are much less social (e.g., housework), one might wonder whether the links between happiness and interaction partners that we documented in the present study are simply a by-product of daily activities.

To test whether the links between happiness and social behavior are actually independent of the effects of happiness on general daily activities, we reran all of our analyses, controlling for whether participants were engaged in each of the 15 aforementioned activities at time *t* + 1. Note that the sample size for these analyses was reduced to 177,978 pairs of observations because the item requesting participants to report their activities appeared (at random) in combination with our target interaction partner item on only 81% of the samples. For parsimony, here we report analyses only on the reduced sample (i.e., listwise deletion). Note that analyses using multiple imputation to deal with missing values led to virtually identical results (see Section 5.1 in the Supplemental Material).

Overall regression analyses controlling for daily activities yielded results that were similar to the regressions without these covariates. Specifically, regardless of the specific activities that they would be engaging in, the happier participants were at time *t*, the less likely they were to be in the presence of other people at time *t* + 1. For instance, if participants' current happiness was 1 standard deviation above the sample mean, the adjusted *OR* of subsequently reporting being in the presence of other people was 0.95, 95% CI = [0.93, 0.96], $p < .0001$. Breaking down the results by specific categories of interaction partners, we found that regardless of the specific activities that they would be engaging in, when participants' current happiness was 1 standard deviation below the sample mean, they were more likely to later interact with their friends, adjusted *OR* = 1.19, 95% CI = [1.15, 1. 22], $p < .001$; best friend, adjusted *OR* = 1.09, 95% CI = [1.06, 1.11], $p < .001$; other family members, adjusted *OR* = 1.12, 95% CI = [1.08, 1.12], $p < .001$; kids, adjusted *OR* = 1.06, 95% CI = [1.03, 1.10], $p < .001$; and siblings, adjusted *OR* = 1.04, 95% CI = [1.00, 1.08], $p = .03$. In contrast, when participants' current happiness was 1 standard deviation above the sample mean, they were more likely to later interact with strangers, adjusted *OR* = 1.05, 95% CI = [1.00, 1.10], $p = .03$. Finally, current happiness was largely unrelated to subsequent interactions with people who had little hedonic impact, namely, acquaintances, adjusted *OR* = 1.02, 95% CI = [0.99, 1.05], $p = .22$; parents, adjusted *OR* = 1.02, 95% CI = [0.99, 1.04], $p = .32$; and coworkers or clients, adjusted *OR* = 0.99, 95% CI = [0.95, 1.03], $p = .49$. Again, an exception to this pattern were interactions with one's romantic partner, which despite being positive in terms of happiness impact, were not reliably predicted by participants' previous happiness levels, adjusted *OR* = 1.00, 95% CI = [0.98, 1.03], $p = .80$.

In a further test of the independence of the present findings from our prior report of a link between happiness and general daily activities, we examined

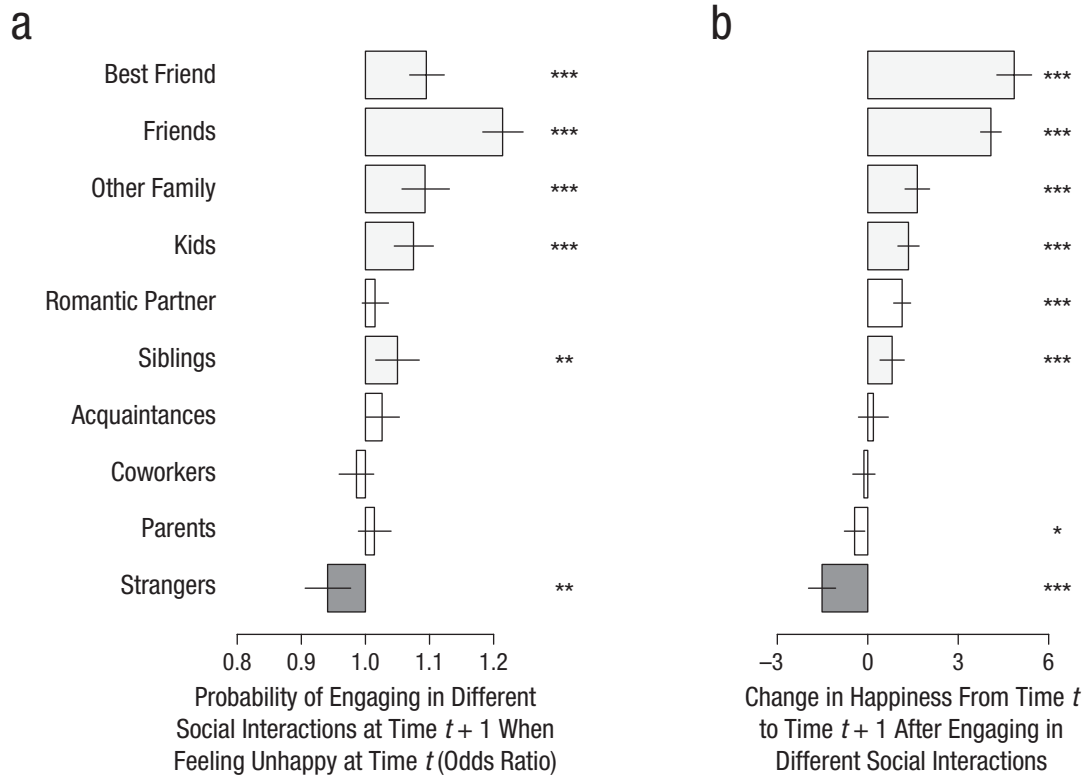

Fig. 3. Associations between momentary happiness and social behavior. The relationship between participants' current unhappiness (at time *t*) and their propensity to later engage with different interaction partners (at time $t + 1$) is shown in (a). The relationship between people's interaction partners (at time $t + 1$) and their change in happiness (difference between happiness at time *t* and happiness at time $t + 1$) is shown in (b). For (a), the effect of feeling unhappy was fixed to 1 standard deviation below the sample mean. Light gray bars indicate significant increases, dark gray bars indicate significant decreases, and clear bars indicate no significant change. Asterisks indicate results significantly different from 0 (*$p < .05$, **$p < .01$, ***$p < .001$, after Benjamini-Hochberg correction for multiple testing). Error bars depict 95% confidence intervals.

whether the type of activities that people engaged in significantly moderated the relationship between happiness at time *t* and social behavior at time $t + 1$. In line with what one would theoretically expect for the hedonic-flexibility principle, if participants' current happiness was 1 standard deviation below the sample mean, the likelihood of subsequently reporting being in the presence of other people was smaller if participants were engaged in any of the 10 pleasant activities, adjusted $OR = 0.93$, 95% CI = [0.91, 0.95], $p < .001$, than if participants were engaged in any of the 5 unpleasant activities, adjusted $OR = 0.95$, 95% CI = [0.93, 0.98], $p < .0001$. One interpretation of these findings is that if people are already doing an activity that might help regulate their negative mood (e.g., going for a hike), they might not feel as much need to further regulate their emotion through social behavior (e.g., calling a friend), compared with if they are engaged in an activity that does not help with their negative mood (e.g., housework; see Section 5.2 in the Supplemental Material).

Taken together, these findings provide strong evidence for the notion that happiness relates to social interaction patterns in addition to, and independently of, the type of activities that people are currently engaged in.

Can the relationship between happiness and social behavior be explained by daily rhythms? An examination of the coefficients in Models 1 and 2 revealed that our findings could not be explained by the natural rhythm of social interactions. Specifically, the correlation (*r*) between the different γ_c^js in Model 1 and in Model 2 was .99, $p < 10^{-16}$, and all significant γ_c^js in Model 1 remained significant in Model 2. Similarly, an examination of the coefficients in Models 1 and 3 revealed that our findings could not be explained by natural rhythms of happiness. Specifically, the correlation between the different γ_c^js in Model 1 and in Model 3 was .99, $p < 10^{-16}$, and all significant γ_c^js in Model 1 remained significant in Model 3 (see Section 4 in the Supplemental Material).

Taken together, these findings provide strong evidence for the notion that happiness relates to social interaction patterns in addition to, and independently of, daily social and affective fluctuations.

Discussion

Our findings challenge the notion that happiness and social behavior relate to one another in a simple reciprocal and symmetrical fashion. Whereas our large-scale investigation of everyday life confirms that relationships with people who are close are crucial to happiness, we also demonstrate that happiness relates to people's social behavior in more complex ways than previously acknowledged. As we predicted using the hedonic-flexibility principle, people seek happiness-enhancing social relationships when they feel bad and are more likely to sustain happiness-decreasing periods of solitude or engage in less pleasant types of social relationships that might promise long-term payoff when they feel good. Our data cannot directly tell us whether spending at least some portion of the time alone and regularly meeting new people predict enhanced psychological and social adjustment 5 or 10 years later. Yet research does suggest that although solitude can increase loneliness and negative affect, it may also offer opportunities for concentration, renewal, autonomy, and spirituality, which might be adaptive (Larson, 1990; Long & Averill, 2003). Likewise, a large body of work has consistently demonstrated the importance of building and maintaining strong social networks on mental and physical health (Holder & Coleman, 2007; Lee & Ishii-Kuntz, 1987; Pinquart & Sörensen, 2000).

By examining a broad range of social relationships simultaneously, our study helps reconcile seemingly conflicting prior findings: Both happiness and unhappiness can promote social behavior but toward different types of people. In line with research on coping (e.g., Parker & Brown, 1982), attachment (e.g., Ainsworth et al., 1978), and mood repair (e.g., Isen, 1984), our results show that people tend to seek loved ones when they feel unhappy. But in line with research on emotion, our study found that people also tend to be social with people they know less well when they feel happy. These findings also dovetail with previous research on goal pursuit, which shows that positive affective states can help in accomplishing tasks that have short-term hedonic costs but long-term benefits. For example, happy moods help children forgo the opportunity to eat a pretzel now in order to obtain a more desired lollipop later (Moore, Clyburn, & Underwood, 1976), increase students' interest in potentially useful information about their personal shortcomings (Raghunathan & Trope, 2002), and motivate young adults to carry through with their professional and fitness goals (Mead, Patrick, Gunadi, & Hofmann, 2016).

Our large sample size also allowed us to examine how specific everyday relationships relate to our happiness. In line with previous research (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004; Larson et al., 1986), our results showed the strongest associations between momentary happiness and spending time with friends (and a best friend), although these were still relatively small effect sizes. Also supporting the research on weak ties, our study found a very small positive relationship between the amount of time that people spent with acquaintances and their average happiness (Sandstrom & Dunn, 2014b). Note, however, that interacting with acquaintances was largely unrelated to momentary happiness, suggesting that the effect of weak ties on happiness might be due to participants feeling that being with acquaintances was better than being alone rather than that the acquaintances were enjoyable in and of themselves. Finally, interacting with strangers was associated with lower happiness. This finding is in line with people's intuition (many of us dread interacting with strangers; Epley & Schroeder, 2014) but contrasts with previous experimental studies showing that when instructed to engage in a conversation with a stranger, people report increased happiness (Epley & Schroeder, 2014; Sandstrom & Dunn, 2014a). Crucially, in these studies, participants were instructed to actively try to make a connection with other people, smiling, making eye contact, and getting to know them. Although such carefully crafted interactions might make us happier, results from our large sample support the intuition that interactions with strangers are, on average, unpleasant.

Previous findings regarding the emotional benefits of interacting with family members have been mixed, with some studies finding a positive relationship (e.g., MacKerron & Mourato, 2013) and others finding either no relationship or a negative one (e.g., Cohler & Lieberman, 1980; Larson et al., 1986). By breaking down family members into more specific categories, we show that spending time with one's family is related to momentary happiness but more so for extended family members (e.g., a cousin) than direct ones such as siblings, romantic partners, and children. In fact, interacting with one's parents was weakly but negatively correlated with momentary happiness, perhaps because the relationships that many adults have with their older parents are often highly ritualized and include frequent experiences of shame and guilt (Hess & Waring, 1978; Rosow, 1967).

The associations that we found between interactions with romantic partners and happiness also bear comment. First, whereas interacting with most interaction partners related in comparable ways with both average and momentary happiness, there was an asymmetry between the relatively large effect that spending time with romantic partners had on people's average happiness—the largest correlation in our data—and the relatively small effect that spending time with romantic partners had on people's momentary happiness. One potential explanation for this discrepancy could be that the larger correlation between romantic partners and average happiness reflects, in part, the fact that happier individuals are more likely to be in a romantic relationship (Lucas, Clark, Georgellis, & Diener, 2003; Marks & Fleming, 1999). A second possibility is that the coupling between one's current affective state and the propensity to later engage in a social interaction works differently for romantic partners compared with other relationships. Specifically, it is possible that there is a much greater mix of instrumental and hedonic motivations in romantic relationships than in other relationships. It could also be that societal roles, expectations, and structural patterns of cohabitation may lead people to spend much more time with their romantic partners that would be justified by a moment-to-moment hedonic accounting process.

Although the present research shows that there are robust associations between happiness and daily social interactions, it is important for future research to address several limitations. First and foremost, because of the correlational nature of our data, we cannot exclude the possibility that a third variable (e.g., loneliness, fatigue) may have driven the associations that we observed. Likewise, reversed causality is also a possibility (e.g., knowing that they have to engage with strangers in an hour, people may try to proactively bolster their mood beforehand). To address these concerns, researchers could manipulate happiness, for example, by sending positive or negative stimuli to people's phones and tracking how this impacts their subsequent patterns of social interactions. Second, to minimize the burden on participants, we relied on a general, unidimensional measure of happiness. In further research, it is important to examine how more fine-grained affective states, including specific emotions, relate to social behavior, because affective states of similar valence can lead to opposite action tendencies (e.g., fear and anger; Lerner & Keltner, 2001).

Finally, the present study focused on a fixed number of categories of interaction partners and detected effects that differed, on average, across categories in both direction and magnitude. One important direction for future research is to more precisely delineate social categories and their attendant effect sizes. This is an important question because whereas the present results suggest that the most positive interaction partners (i.e., best friends) are more strongly associated with happiness increases than the most negative interaction partners (i.e., strangers) are associated with happiness decreases, the relative balance of effect sizes between positive and negative interactions may substantially differ if more categories of interaction partners (e.g., one's rival) are included. In addition, it would be important to examine whether individual and cultural differences exist in the extent to which different interaction partners make people happy and in the extent to which affective considerations relate to people's daily patterns of interaction. Investigating how happiness relates to social behavior across various social categories and for various groups of individuals and cultures represents an exciting avenue for future work.

It has long been thought that happiness and social behavior have strong symmetrical links. The present findings provide robust support for the idea that being with other people is associated with both greater momentary and overall happiness. However, our findings suggest that happiness is not always associated with social behavior. Although people may be more likely to approach a stranger when they feel happy, they in fact tend to engage in most social relationships—particularly with friends and family—when they feel unhappy. These findings support the hedonic-flexibility hypothesis and shed important new light on how people navigate their social lives, balancing relationships that may bring them short-term happiness gains and long-term welfare.

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Author Contributions

J. Quoidbach and M. Taquet contributed equally to this work. J. Quoidbach and J. J. Gross wrote the main text. M. Taquet analyzed the data and prepared the figures. M. Desseilles and Y.-A. de Montjoye helped with the data collection. All the authors approved the final manuscript for submission.

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Open Practices

All data and materials have been made publicly available via the Open Science Framework and can be accessed at https://osf.io/fnps3. The design and analysis plans were not preregistered. The complete Open Practices Disclosure for this article can be found at http://journals.sagepub.com/doi/suppl/10.1177/0956797619849666. This article has received the badges for Open Data and Open Materials. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges.

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